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SOUTH TEXAS NUCLEAR PROJECT
WADSWORTH, TEXAS

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I.   SUMMARY

In August of 1986, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate an outbreak of dermatitis at a nuclear power plant construction site. Workers believed the dermatitis to be a consequence of handling fire-retardant lumber and plywood.

NIOSH officers visited the plant on September 17 and November 18, 1986, and examined workers. They typically had an eczematous rash on the wrists and arms. Some workers had pruritic, macular-papular lesions. Other parts of the body affected included the shoulders and flank. Workers reported that the rash began at work and lasted from days to weeks. Most workers reported they were not bothered in previous years. An analysis of the nurse's log indicated that risk for a skin condition in 1986 was more than 250% that of 1985. Among the various tradesmen at the site, the risk of a skin condition was greatest for carpenters, who had almost 10 times the reported rate of skin conditions in 1986 than in 1985. The outbreak of dermatitis followed a seasonal pattern, increasing with hot weather and falling off with the return of cold weather.

A medical survey of all carpenters was conducted on November 18, 1986. Results indicated that carpenters working inside the power plants were at highest risk of dermatitis. Carpenters who worked part of the time inside the power plants were at moderate risk. Those who worked only outside the power plant were at lowest risk. No other factors appeared to influence the distribution of rash among the carpenters.

To determine whether the source of the rash was from an airborne contaminant, general area environmental air samples were collected on November 18, 1986, in the carpenter shop. Airborne phosphate, melamine, dicyandiamide, and formaldehyde (substances typically used by fire-retardant lumber manufacturers) were not detected. Total particulate concentrations ranged from 0.1 to 0.6 milligrams/cubic meter (mg/m^3). Analysis of samples of fire-retardant plywood and lumber showed that both contained phosphate, approximately 3% and 5%, respectively. The arsenic content of both materials was less than the limit of quantitation. The plywood sample had an average value of 59 ppm (parts per million) formaldehyde. Extracts from fire-retardant samples were tested for dermal toxicity based on erythema and edema. There was no apparent irritant potential for the extractions of the fire-retardant wood. The testing of the wood extract does not definitively exclude the fire-retardant wood as a cause of the epidemic because of possible variation in each batch of wood. Also, testing the extract may not have been a sufficiently sensitive technique.

Based on these results, the investigators concluded that the affected workers most likely had a contact dermatitis, as a result of contact with an irritant at work. Carpenters working on scaffolding crews were at greatest risk, and those working with both fire-retardant and non-treated lumber were at moderate risk, compared to carpenters working exclusively with non-treated lumber. The precise cause of the contact dermatitis was not identified. Although formaldehyde was found in a bulk sample of the treated wood, toxicity testing of the wood did not indicate a potential chemical/physical cause of the dermatitis. Recommendations to reduce contact with the wood/lumber and to monitor the occurence of dermatitis are included in Section VIII of this report.

KEYWORDS: SIC 1629 (power plant construction), dermatitis, rash, fire-retardant lumber and plywood

II. INTRODUCTION

In August 1986, the National Institute for Occupational Safety and Health (NIOSH) received a confidential request to evaluate an outbreak of dermatitis at the South Texas Project nuclear power plant construction site in Wadsworth, Texas. Workers believed the rash to be a consequence of handling fire-retardant lumber and plywood. A report of the interim findings from the 1986 visits was distributed in May 1987.

III. BACKGROUND

The South Texas Project (STP) nuclear power plant is located in the coastal plains of Texas on a 12,200-acre site between Bay City and Palacios, west of the Colorado River in Matagorda County. Part of the acreage is being retained as a natural lowland habitat for wildlife. Some 500 acres are devoted to the plant and 7,000 acres to an above ground, man-made cooling reservoir. At one time, this was the single largest construction site in the United States. During our investigation, more than 5600 tradesmen were employed by the primary contractor.

STP consists of two 1,250,000-kilowatt generating units. Unit 1 was more than 92 percent complete as of July 1986 and was scheduled to begin operating in late 1987. Unit 2 was more that 62 percent complete and was expected to go on-line in 1989. STP is jointly owned by Houston Lighting & Power Company, City Public Service of San Antonio, Central Power and Light Company, and the City of Austin. Bechtel Energy Corporation is the architect/engineer of the STP. The builder is EBASCO Construction Inc., and overall control of the construction is the responsibility of Houston Lighting and Power Company.

Carpenters work in small crews and are assigned to work on concrete forms, on scaffolding in the power plants, or on temporary facilities. Those assigned to temporary facilities fill in where necessary or are involved in construction of temporary buildings outside the power plant. Fire-retardant lumber and plywood are used for constructing scaffolding and temporary structures inside both power plants. The treated lumber is more expensive than untreated lumber and is not used outside the power plants or for concrete forms. As a result, carpenters assigned to scaffolding crews inside the plants work exclusively with fire-retardant material, while those making concrete forms work with untreated lumber. Carpenters assigned to temporary facilities are exposed to treated lumber when they work inside the power plants or, as sawyers, must cut both types of lumber. Their exposure to this material is less than that of the scaffolding crews but greater than that of the workers building concrete forms.
The fire-retardant lumber is treated by its supplier using a proprietary process. The literature indicates that this process typically involves the combination of a nitrogen source (i.e., urea, melamine, guanidine, or dicyandiamide) with formaldehyde to produce a methylolated amine. The resulting chemical product is then reacted with a phosphorus compound such as phosphoric acid.[1] The supplier of the fire retardant lumber stated that the chemicals used in the manufacturing process are converted to a phosphate compound.

All medical care is provided by a medical facility to which all workers have access. A record of employee visits to the medical facility is kept by the nurse; it includes the employee badge number and trade, the nature of the problem, the date of the visit, the part of the body affected, and the unit and building where the employee worked.

IV.   EVALUATION DESIGN

A.   Environmental

To investigate the possibility of an airborne contaminant as the source of the symptoms experienced among the carpenters, environmental monitoring was conducted at stationary positions within the carpenter shop. Bulk samples of the wood were analyzed for various contaminants.

Ten samples for total particulate were collected on pre-weighed FWSB filters using a battery-powered vacuum pump at an air flow rate of 2.0 liters per minute (lpm). The total weight of each sample was

determined by weighing the sample plus the filter on an electrobalance and subtracting the previously determined tare weight of the filter. The tare and gross weighings were done in duplicate.

Five air samples were collected in impinger samplers at a rate of one liter per minute and analyzed for formaldehyde by the chromotropic acid method (NIOSH 3500)[2]. The samples were collected in distilled water instead of sodium bisulfite due to a laboratory error in preparing the sampling medium.

Five air samples for phosphate were collected on pre-weighed FWSB filters at a flow rate of 2.0 lpm and analyzed on a DIONEX 2010 ion chromatograph equipped with an AG4A/AS4A Anion separator column and a microfiber suppressor.

Five air samples for melamine and dicyandiamide were collected on pre-weighed FWSB filters at a flow rate of 2.0 lpm. The filters were extracted with 4 ml of deionized water and analyzed by high pressure liquid chromatography (HPLC). Two bulk samples of fire-retardant wood dust were analyzed for arsenic content. Three replicate aliquots of each sample were weighed and then digested with concentrated nitric and perchloric acids. The residues were dissolved in a dilute solution of the same acids and the resulting sample solutions were analyzed for arsenic content by inductively coupled plasma-atomic emission spectometry (ICP-AES).

Two bulk samples of fire-retardant lumber were analyzed for phosphate content. These samples consisted of small wood chips from treated plywood and from a treated board. A portion of each sample was weighed and extracted with ten milliliters of water. These samples were allowed to sit at room temperature for four hours with occasional shaking. They were also sonicated for 15 minutes during this extraction period. The samples were then diluted with deionized water and analyzed by ion chromatography (IC).

Two bulk samples of fire-retardant lumber were analyzed for latent formaldehyde. One sample consisted of wood shavings from a board; the other was wood shavings from plywood. Both samples were run in duplicate. A modification of the Burlington Industries method for latent formaldehyde was used for the analysis of these samples. Approximately one gram of each sample was suspended over 50 milliliters of distilled water in a sealed container, and the latent formaldehyde was collected over a 20-hour period at 50°C. A 10-ml aliquot of the sample was reacted with chromotropic acid and sulfuric acid and the resulting absorbance read on a Beckman Model 26 spectrophotometer set at 750 nm. Quantitative results were determined by comparison of the absorbance exhibited by the samples with that of standard solutions.

B.   Medical

1.   Characterization of the dermatitis

During the initial site visit workers with rash, identified during the walk-through or referred by the union or medical department, were examined. The rash was characterized by appearance and anatomical distribution.

2.   Characterization of the outbreak

The outbreak was characterized by person, place, and time. This was accomplished by reviewing the nurse's log for visits to the medical facility for skin related complaints from February 2 through September 9, 1986. An update of the nurse's log was provided in late October and covered September 10 through October 19, 1986. At this time we also received the nurse's log data for all of 1985.

These records were used in the following manner:

a)   Visits to the medical facility for a skin condition, from February 2 through October 19, 1986, were identified and pertinent information abstracted.

b)   An episode of a skin condition was defined as a visit to the medical facility for any skin-related complaint that had not been preceded in the past 30 days by an earlier visit.

3.   Determination of risk factors

A survey of carpenters at the construction site to identify factors associated with the occurrence of rash was conducted on November 19, 1986. A self-administered questionnaire was given to each carpenter at work on that day. Information sought included demographics, work history, history of skin conditions and allergies, exposure to fire-retardant lumber, and use of protective clothing. The questionnaires were distributed by the foreman of each crew. All questionnaires were completed on the same day, at the beginning of each shift, placed into a sealed envelope, and returned to the NIOSH investigators. The questionnaires were immediately reviewed. A sample of carpenters who indicated that they had a current rash, and an equal number who reported no rash, were examined by a physician. The physician's determination of whether a respondent had a rash that may have resulted from exposure to an irritant was used to determine the accuracy of the questionnaire in determining the presence of rash.

4.   Toxicity testing

Fire-retardant 2 X 4 lumber and plywood and untreated 2X4 lumber were collected from the site. Wood slivers were soaked in deionized water or artificial sweat for 12 hours in a ratio of 2 grams of wood to 20 mL of solvent. The total volume of each extract was approximately 100 mL.

The six extracts, a deionized water blank and an artificial sweat blank were then analyzed for total phosphate. After making dilutions, each sample was injected into a Dionex 2010i ion chromatograph equipped with an AGH/AS4 anion separator column system, micromembrane supressor, and conducting detector. Anions were eluted with 3.0 ml $NaHCO_3$ eluent. Identity of phosphate was accepted as the peak having the same retention time as the lab standard under the same chromatograph conditions. The eluent was selected to ensure separation of phosphate from other possible interfering anions.

The primary skin irritancy of 4 extracts (treated wood extracted in water or artificial sweat, untreated wood extracted in deionized water or artificial sweat) and two blanks (deionized water and artificial sweat) was evaluated. A small amount (0.5 mL) of the six undiluted test materials was applied to intact skin sites on six New Zealand White rabbits (three males and three females) and allowed to remain in contact with the skin for 24 hours. The sites were scored for edema and erythema and checked for tissue damage at the end of the application period (24-hour reading) and two days later (72-hour reading) according to the method of Draize (3).

V.   EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

VI.   RESULTS AND DISCUSSION

   A.   Environmental

       Results of the area air samples collected on November 18, 1986, in the Carpenter Shop for total particulate, phosphate, melamine, dicyandiamide, and formaldehyde are presented in Table I. The survey demonstrated that the 8-hour TWA exposures for total particulate concentrations ranged from 0.12 to 0.58 mg/m^3. The ACGIH TLV for total particulate is 10 mg/m^3. The OSHA PEL is 15 mg/m^3. No airborne phosphate, melamine, dicyandiamide, or formaldehyde was detected; limits of detection were 5, 5, 130, and 2 ug/sample, respectively.

       The arsenic content of both wood samples was less than 0.01% by weight, which is the limit of quantitation for this sample set.

       Phosphate (as PO_4^{-2}) was present in two wood samples at concentrations of 3.2% and 4.7% by weight. Given the nature of the samples, these results should be considered semiquantitative. The actual results obtained may be affected by such features as particle size distribution and total surface area. Results indicate, however, that phosphate may be leached from the surface with water.

       A calibration curve for formaldehyde was established over the range of 3 ppm to 450 ppm, assuming a 1-gram bulk sample. Linear regression analysis of the curve yielded a limit of quantitation (LOQ) of 28 ppm and a limit of detection (LOD) of 8 ppm per sample. The 2 x 4 wood sample had an average formaldehyde content below 8 ppm. The plywood sample had an average of 59 ppm.

B.   Medical

l. Characterization of the dermatitis

All workers examined on September 17, 1986 presented with an eczematous rash over the wrist and arms. Some workers had pruritic, macular-papular lesions. Other parts of the body affected included the shoulders and flank. Workers reported that the rash began while at work and lasted from days to weeks. Most workers said that they did not have a rash in previous years.

2.   Characterization of the outbreak.

Between February 2 and October 19, 1986, there were a total of 445 visits, from 407 workers, to the medical facility for a skin problem. A total of 120 visits were made from February through October in 1985. The relative risk (RR) for a skin condition in 1986, compared to 1985, was 2.68 (95% confidence intervals: 2.22, 3.23). Figure 1 shows the relative rate of rash by month for 1986, compared to 1985. Until April, the rate of visits for skin problems was similar in 1985 and 1986. By May the rate in 1986 was greater than that in 1985. The relative difference continued to increase into the summer months and reached a maximum in September. During both years, the rate increased into the summer. In addition there was an increase in the rate of worker visits to the medical facility for skin related problems in 1986.

The risk of a skin condition by trade was examined. In September 1986, the workforce consisted of approximately 1926 pipefitters, 1506 electricians, 651 laborers, 373 carpenters, 475 iron- and sheetmetal workers, and a small number of painters, truck drivers, boilermakers, plumbers, millwrights, and concrete finishers. The rate of visits for a skin condition per 100 workers is presented by trade in Figure 2. In 1986, almost 35% of the carpenters reported to the nurse with skin problems. In contrast, approximately 10% of the iron workers, concrete workers, and laborers were seen. The change between 1985 and 1986 was greatest for carpenters, with almost 10 times the rate of skin conditions in 1986 compared to 1985.

For the workers with a skin condition, whose job site was known, 89% worked in one of the two power plants. The risk of working in these buildings could not be estimated since denominator data were not available. The part of the body affected was known for 351 of the cases in the nurse's log. The majority (80%) involved the upper extremities, 69 on the hands and 213 on the arms.

3.   Determination of risk factor

On November 19, 1986, 3l0 of 338 (92%) carpenters completed the questionnaire. The responses on the survey instrument were used to define a case of rash: a carpenter with a red rash of the upper extremities, with or without pustules, accompanied by itching and/or burning, and with date of onset no earlier than January 1, 1986. All other carpenters were considered to be non-cases. The questionnaire case definition was compared to the results from a physical examination of carpenters with a current skin condition (Table 2). Twenty-four carpenters with a current skin condition (31%) and 22 without a current skin condition (9%) were examined. Twelve carpenters met the questionnaire case definition for a rash. The physician considered 11 of 24 workers with a current skin condition as having a rash compatible with a contact dermatitis. Using the physician's examination results as the standard, the case definition had a sensitivity of 82% and a specificity of 91%.

One hundred and eighty-one carpenters reported a skin condition on the questionnaire. Of these, 99 (55%) met the case definition. Rash was not associated with race or a history of atopy (allergy manifested as hayfever, asthma, hives or eczema). When carpenters with and without rash were stratified by work with fire-retardant lumber. Scaffolding crews (who had the highest exposure) were at greater risk (RR = 3.6; 95% CI = 1.5, 8.6) than carpenters working exclusively with concrete

forms (Table 3). Foremen and temporary facility workers were at moderate risk (RR=2.2). Forty-seven carpenters were excluded because they worked in more than one of the three categories. A Mantel-Haentzel X^2 test for dose-response was highly significant (X^2=9.78, p=0.001).[3]

Work by carpenters with fire-retardant lumber and work inside the power plant could not be separated, so it was not possible to stratify on these variables. There is a possibility that the outbreak of rashes was caused by factors other than fire-retardant lumber that were related to work inside the power plants. Since carpenters were at higher risk than others who also worked inside the power plants (and a factor other than the treated lumber was responsible) carpenters inside the power plant would be more likely to be exposed to it than either other carpenters or other tradesmen.

The survey did not establish the protective properties of long-sleeve shirts and gloves. This may have been because carpenters could not recall the exact day when they developed a rash and the clothing they were wearing on that day. Furthermore, a company policy, issued in early October 1986, required all carpenters to wear such protective clothing. This may have affected the accuracy of questionnaire responses regarding the use of protective clothing.4. Toxicity Testing

The results of the analyses of the six extracts and two blanks for total phosphate concentrations are given in Table 4. Phosphate concentrations evaluated by NIOSH ranged from 4.l to 7.1 mg/g wood in the samples from treated plywood and wood. The extracts of the untreated wood and the two blanks had no detectable phosphates. Samples of 2 X 4 treated wood and treated plywood collected by EBASCO and tested by a contract laboratory in September 1986 had 5.8 and 3.8 mg phosphate per gram of wood (table 4). The total phosphate concentrations of the extracts carried out by the contract laboratory and the NIOSH laboratory appear to be within the same range. This suggests that there was no substantial difference between the phosphate concentrations of the woods tested.

The results of the 24-hour application of the test materials to six intact skin areas of rabbits and the specific observations of the skin sites with regard to irritation and other effects are summarized in Table 5. The Primary irritation index for each sample, based on erythema and edema ranked from lowest to highest, were: water blank (0.0), untreated wood extract in artificial sweat (0.1), untreated wood in deionized water (0.2), treated wood in artificial sweat (0.4), artificial sweat blank (0.5), and the treated wood in deionized water (0.5). There was no apparent difference between the samples in irritant potential. None of the extractions tested appear to be a primary irritant to the skin.

VII.   CONCLUSIONS

Construction workers developed a rash, probably as a consequence of exposure to an irritant at work. Carpenters were at greater risk than other workers. The large number of cases and the distribution of the rash on the hands and arms suggests that dermatitis in most workers was an irritant reaction.

The distribution of the cases by time indicates that a substantial increase in cases occurred in 1986 compared to 1985 and that this increase was especially apparent in the summer months. The incidence of rash declined again as the weather cooled. This suggests that there may be an interaction between heat and/or humidity and contact with an irritant inside of the power plant.

Although the risk of dermatitis was clearly greatest among carpenters handling fire-retardant lumber, toxicity testing with various wood extracts did not support the hypothesis that the dermatitis was due to

a chemical irritant effect of the treated wood. However, it is important to note that where a positive test result would support the hypothesis, the negative results do not necessarily rule out the fire-retardant lumber as the causative agent. The negative findings may have resulted from limitations of the test and/or variables that were not controlled such as, 1) a variation in the fire-retardant lumber (i.e. the particular lumber subjected to toxicity testing did not contain the substance responsible for the symptoms), 2) a physical characteristic of the lumber necessary for a reaction to develop, or 3) conditions inside the power plant, such as high heat and humidity, acting in combination with the fire-retardant lumber.

There are no reports in the literature of dermatitis following exposure to fire-retardant lumber. Another fire-retardant material, tris(2,3-dibronopropyl)phosphate (TRIS), used as a fire-retardant of childrens clothing, has been reported to cause dermatitis.[4] Treated lumber from a new supplier was first shipped to the project on April 11, 1986. This new formulation or a single batch of toxic timber may have been the cause of the problem.

Uncured resins (such as melamine-formaldehyde) are a recognized cause of occupational dermatitis.[5] Although analysis of the bulk wood samples for formaldehyde was qualitative in nature; i.e. the type of analysis used does not distinguish between the amount of "free" (available) formaldehyde and the amount driven off by the heat involved in the analytical process, the presence of formaldehyde in the wood products was demonstrated. Because formaldehyde is so well recognized as causing a variety of cutaneous problems in humans,[6] the source of the dermatological symptoms experienced by the carpenters may well be formaldehyde in the treated lumber. Seasonal variation in onset and degree of symptoms may be directly attributable to the degree of perspiration generated by the employees and behaviors attributable to warm weather (i.e. use of short sleeve garments).

VIII.   RECOMMENDATIONS

1.   Carpenters working on scaffolding crews and, those sawing treated lumber, should wear gloves and long-sleeve shirts whenever practical.

2.   Carpenters sawing wood should wear particulate masks to avoid inhalation exposure to wood dust.

3.   Personal hygiene measures, including washing of hands and arms at lunch and following work, should be made mandatory.

4.   Medical surveillance should be continued to monitor construction workers for dermatitis, and attempts should be made to differentiate between a contact irritant dermatitis and other skin conditions.

IX. REFERENCES

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X. AUTHORSHIP AND ACKNOWLEDGEMENTS

XI.   DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Publications Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. South Texas Nuclear Project
2. Houston Lighting & Power
3. EBASCO
4. Confidential Requester
5. NIOSH, Region IV
6. OSHA, Region IV

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE 1

RESULTS OF AREA AIR SAMPLES FOR TOTAL PARTICULATES

South Texas Nuclear Project
Wadsworth, Texas
HETA 86-456
November 18, 1986

LOCATION	PERIOD	(LITERS)	mg/m^3*
14" DeWalt Table Saw	0850-1525	790	0.33
20" DeWalt Arm Saw	0855-1531	792	0.27
Finish Table Saw	0858-1537	798	0.50
Make Up Table	0900-1544	808	0.17
Wood Lathe	0905-1549	808	0.30
14" DeWalt Table Saw	0850-1525	790	0.19
20" DeWalt Arm Saw	0855-1531	792	0.15
Finish Table Saw	0858-1537	798	0.58
Make Up Table	0900-1544	808	0.15
Wood Lathe	0905-1549	808	0.12

Environmental Criteria mg/m3			10
Limit of Detection			0.01mg

*mg/m^3 = milligrams of substance per cubic meter of air sampled

Table 2

CASE DEFINITION FOR RASH[*] USING PHYSICIAN'S IDENTIFICATION AS THE STANDARD.

South Texas Nuclear Project
Wadsworth, Texas
HETA 86-456
November 18, 1986

Physician's Determination

Questionnaire	Rash	Other Skin Condition or normal skin.	Totals
Rash	9	3	12
Other skin conditions plus normals	2	32	34
Totals	11	35	46

Sensitivity = 9/11 = 82%
Specificity = 32/35 = 91%

[*]   A rash was defined as a self-reported red rash on the upper extremities which caused itching and/or burning and did not begin before January 1, 1986.

Table 3

RISK OF RASH AND WORK WITH FIRE-RETARDANT LUMBER, 1986.

South Texas Nuclear Project
Wadsworth, Texas
HETA 86-456
November 18, 1986

| | Work with Fire Retardant Lumber | | | |
	0^*	1^*	2^*	Totals
Rash	3	11	72	86
No Rash	25	36	116	177
Totals	28	47	188	263

$X^2_{MH}= 9.78$ p= 0.001

| | Work with Fire Retardant Lumber | | |
	0	1	2
Relative Risk	1.00	2.18	3.57
95% Confidence Intervals	--	(0.7, 6.7)	(1.5, 8.6)

[*] Carpenters were exposed to fire-retardant lumber as follows:

0 =   Carpenters assigned to working on concrete forms who did not work with fire-retardant lumber.

1 =   Carpenters assigned as foremen or to temporary facilities. They were exposed to fire-retardant lumber occasionally.

2 =   Carpenters working on scaffolding crews inside the power plants. They worked exclusively with fire retardant lumber.

Table 4
EXTRACTS FROM WOOD
FOR DERMAL TOXICITY TESTING
South Texas Nuclear Project
Wadsworth, Texas
HETA 86-456
November 18, 1986

----Phosphate Concentration*----

	NIOSH Extractions	Consulting Lab
Fire-retardant 2 X 4 lumber/water	7.1	5.8
Fire-retardent 2 X 4 lumber/sweat	6.8	
Fire-retardent plywood/water	5.1	3.8
Fire-retardant plywood/sweat	4.1	
Untreated 2 X 4 lumber/water	ND**	
Untreated 2 X 4 lumber/sweat	ND	
Deionized water	ND	
Artificial sweat	ND	

*Concentration of phosphate is expressed as milligrams phosphate per gram of wood.
**ND= none detected.

Table 5

PRIMARY SKIN IRRITANCY SCORES FOR THE EXTRACTS OF
TREATED AND UNTREATED WOODS.

South Texas Nuclear Project
Wadsworth, Texas
HETA 86-456
November 18, 1986

Extract	Average Erythema		Average Edema		PII[*]
	24 hr	72 hr	24 hr	72 hr	
Treated 2 X 4 lumber in water	0.67	0.17	0.17	0.00	0.5
Treated 2 X 4 lumber in sweat	0.50	0.00	0.33	0.00	0.4
Untreated lumber in water.	0.17	0.17	0.00	0.00	0.2
Untreated lumber in sweat	0.17	0.00	0.00	0.00	0.1
Deionized water blank.	0.00	0.00	0.00	0.00	0.0
Artificial sweat blank.	0.67	0.17	0.17	0.00	0.5

Scoring key for skin reactions for primary skin reactions in rabbits.

Erythema and eschar formation	Score
No reaction	0
Very slight erythema	1
Well-defined erythema	2
Moderate to severe erythema	3
Severe erythema to slight eschar formation	4

Edema formation	
No edema	0
Very slight edema	1
Well defined edema	2
Moderate edema (raised approx. 1mm)	3
Severe edema (raised more than 1mm and extending beyond the area of exposure)	4

[*] PII= Primary irritation index. The averages were added together and divided by two to determine the PII.
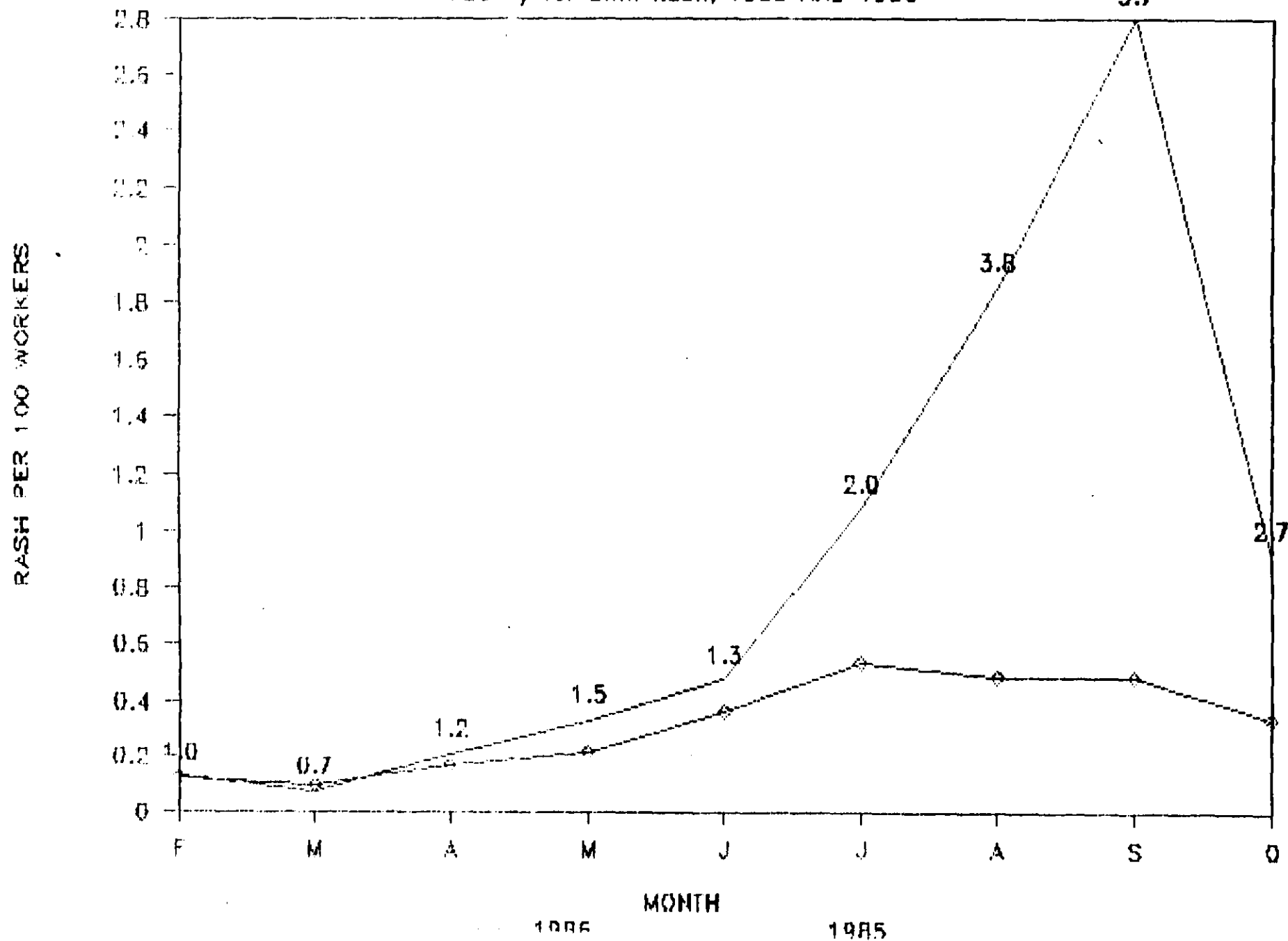
Figure 1: Visits to the Nurses'
Facility for Skin Rash; 1985 AND 1986

Figure 2: Incidence of Dermatitis at
STNP; by Trade and Year.

RATE PER 100 WORKERS

TRADE

1985   1986